

CLAIMS

What is claimed is:

1. A method for performing a finite element simulation, the method comprising switching between an implicit method and an explicit method one or more times during the finite element simulation.
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2. The method of Claim 1 wherein switching occurs automatically.
3. The method of Claim 1 wherein switching is performed manually by an
10 operator.
4. The method of Claim 1 further comprising beginning the finite element simulation using the implicit method.
- 15 5. The method of Claim 1 further comprising beginning the finite element simulation using the explicit method.
6. The method of Claim 1 further comprising ending the finite element simulation if a solution to the finite element simulation is determined using the implicit
20 method.
7. The method of Claim 1 further comprising ending the finite element simulation if a solution to the finite element simulation is determined using the explicit method.

8. The method of Claim 1 further comprising monitoring a number of iterations performed using the implicit method and automatically switching from the implicit method to the explicit method if the number of iterations exceeds a predetermined threshold number.

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9. The method of Claim 1 further comprising monitoring the internal energy of the model during iterations of the implicit method and automatically switching from the implicit method to the explicit method if the internal energy exceeds a predetermined threshold number.

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10. The method of Claim 1 further comprising monitoring a length of time the explicit method has been running and automatically switching from the explicit method back to the implicit method if the length of time exceeds a predetermined threshold time period.

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11. The method of Claim 1 further comprising extending the termination time of the finite element simulation thereby forcing the finite element simulation to end using the implicit method.

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12. The method of Claim 1 wherein the finite element simulation is used to simulate the formation of a metal shape.

13. The method of Claim 1 wherein the finite element simulation is used to simulate the springback of a metal shape.

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14. A computer readable storage medium storing one or more computer programs for performing a finite element simulation, the computer programs comprising instructions for automatically switching between an implicit method and an explicit method one or more times during the finite element simulation.

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15. The computer readable storage medium of Claim 14 wherein the computer programs further comprise computer instructions for beginning the finite element simulation using the implicit method.

10 16. The computer readable storage medium of Claim 14 wherein the computer programs further comprise computer instructions for beginning the finite element simulation using the explicit method.

15 17. The computer readable storage medium of Claim 14 wherein the computer programs further comprise computer instructions for ending the finite element simulation if a solution to the finite element simulation is determined using the implicit method.

20 18. The computer readable storage medium of Claim 14 wherein the computer programs further comprise computer instructions for ending the finite element simulation if a solution to the finite element simulation is determined using the explicit method.

25 19. The computer readable storage medium of Claim 14 wherein the computer programs further comprise computer instructions for monitoring a number of

iterations performed using the implicit method and automatically switching from the implicit method to the explicit method if the number of iterations exceeds a predetermined threshold number.

5 20. The computer readable storage medium of Claim 14 wherein the computer programs further comprise computer instructions for monitoring the internal energy of the model during iterations using the implicit method and automatically switching from the implicit method to the explicit method if the internal energy exceeds a predetermined threshold number.

10 21. The computer readable storage medium of Claim 14 wherein the computer programs further comprise computer instructions for monitoring a length of time the explicit method has been running and automatically switching from the explicit method back to the implicit method if the length of time exceeds a 15 predetermined threshold time period.

22. The computer readable storage medium of Claim 14 wherein the computer programs further comprise computer instructions for extending the termination time of the finite element simulation thereby forcing the finite element 20 simulation to end using the implicit method.

23. The computer readable storage medium of Claim 14 wherein the finite element simulation is used to simulate the formation of a metal shape.

24. The computer readable storage medium of Claim 14 wherein the finite element simulation is used to simulate the springback of a metal shape.

25. A computer system comprising:

5 one or more computers; and
one or more computer programs running on the computer(s), the computer programs for performing a finite element simulation, the computer programs comprising computer instructions for automatically switching between an implicit method and an explicit method one or more times during the finite element simulation.

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26. The computer system of Claim 25 wherein the computer programs further comprise computer instructions for beginning the finite element simulation using the implicit method.

15 27. The computer system of Claim 25 wherein the computer programs further comprise computer instructions for beginning the finite element simulation using the explicit method.

20 28. The computer system of Claim 25 wherein the computer programs further comprise computer instructions for ending the finite element simulation if a solution to the finite element simulation is determined using the implicit method.

25 29. The computer system of Claim 25 wherein the computer programs further comprise computer instructions for ending the finite element simulation if a solution to the finite element simulation is determined using the explicit method.

30. The computer system of Claim 25 wherein the computer programs further comprise computer instructions for monitoring a number of iterations performed using the implicit method and automatically switching from the implicit method to the 5 explicit method if the number of iterations exceeds a predetermined threshold number.

31. The computer system of Claim 25 wherein the computer programs further comprise computer instructions for monitoring the internal energy of the model during iterations of the implicit method and automatically switching from the implicit 10 method to the explicit method if the internal energy exceeds a predetermined threshold number.

32. The computer system of Claim 25 wherein the computer programs further comprise computer instructions for monitoring a length of time the explicit 15 method has been running and automatically switching from the explicit method back to the implicit method if the length of time exceeds a predetermined threshold time period.

33. The computer system of Claim 25 wherein the computer programs further comprise computer instructions for extending the termination time of the finite 20 element simulation if a solution is found using the explicit method thereby forcing the finite element simulation to end using the implicit method.

34. The computer system of Claim 25 wherein the finite element simulation is used to simulate the formation of a metal shape.

35. The computer system of Claim 25 wherein the finite element simulation is used to simulate the springback of a metal shape.

36. A data signal embodied in a carrier wave, the data signal including one 5 or more computer programs for performing a finite element simulation, the computer programs comprising instructions for automatically switching between an implicit method and an explicit method one or more times during the finite element simulation.

37. The data signal embodied in a carrier wave of Claim 36 wherein the 10 computer programs further comprise computer instructions for beginning the finite element simulation using the implicit method.

38. The data signal embodied in a carrier wave of Claim 36 wherein the 15 computer programs further comprise computer instructions for beginning the finite element simulation using the explicit method.

39. The data signal embodied in a carrier wave of Claim 36 wherein the 20 computer programs further comprise computer instructions for ending the finite element simulation if a solution to the finite element simulation is determined using the implicit method.

40. The data signal embodied in a carrier wave of Claim 36 wherein the 25 computer programs further comprise computer instructions for ending the finite element simulation if a solution to the finite element simulation is determined using the explicit method.

41. The data signal embodied in a carrier wave of Claim 36 wherein the computer programs further comprise computer instructions for monitoring a number of iterations performed using the implicit method and automatically switching from the implicit method to the explicit method if the number of iterations exceeds a predetermined threshold number.

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42. The data signal embodied in a carrier wave of Claim 36 wherein the computer programs further comprise computer instructions for monitoring the internal energy of the model during iterations using the implicit method and automatically switching from the implicit method to the explicit method if the internal energy exceeds a predetermined threshold number.

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43. The data signal embodied in a carrier wave of Claim 36 wherein the computer programs further comprise computer instructions for monitoring a length of time the explicit method has been running and automatically switching from the explicit method back to the implicit method if the length of time exceeds a predetermined threshold time period.

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44. The data signal embodied in a carrier wave of Claim 36 wherein the computer programs further comprise computer instructions for extending the termination time of the finite element simulation thereby forcing the finite element simulation to end using the implicit method.

45. The data signal embodied in a carrier wave of Claim 36 wherein the finite element simulation is used to simulate the formation of a metal shape.

46. The data signal embodied in a carrier wave of Claim 36 wherein the 5 finite element simulation is used to simulate the springback of a metal shape.

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